

DOCUMENT RESUME

ED 208 010

TM 810 693

AUTHOR Marlin, Carol A.; And Others
 TITLE Facilitating Recognition Memory: The Use of Distinctive Contexts in Study Materials and Tests.
 PUB DATE Apr 81
 NOTE 21p.; Paper presented at the Annual Meeting of the American Educational Research Association (65th, Los Angeles, CA, April 13-17, 1981).
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS Elementary Education; Grade 3; Grade 4; *Multiple Choice Tests; *Paired Associate Learning; Recall (Psychology); *Recognition (Psychology); *Sentences; Test Items
 IDENTIFIERS *Contextual Associative Method

ABSTRACT

The effects of distinctive background settings on children's recognition memory for subjects and objects of related sentences was examined. As a follow-up to a study by Levin, Ghatala, and Truman (1979), the effects of presenting distinctive background contexts in sentences and multiple-choice tests were separated from the effects of providing such contexts in the sentences alone. Eighty-five grade 3 and 4 students from a racially and economically balanced, Southern elementary school participated in the study. Results indicated that when distinctive contexts were included both in related sentences and in multiple-choice test-item stems, recognition performance was significantly increased. However, the provision of distinctive contexts in the sentences alone did not enhance recognition memory. Results of the study are examined within the framework of the frequency theory of recognition memory.
 (Author/GK)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED208010

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.

☐ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

Facilitating Recognition Memory: The Use Of
Distinctive Contexts in Study Materials and Tests
Carol A. Marlin, Ronald C. Laugen and Teresa R. Hatch
Florida State University

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

R.C. Laugen

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Paper presented at the Annual Meeting of the
American Educational Research Association
Los Angeles, California
April, 1981

Tm 8/0 693

Abstract

The present study examined the effects of distinctive background settings on children's recognition memory for subjects and objects of related sentences. As a follow-up to a study by Levin, Ghatala, and Truman (1979), the effects of presenting distinctive background contexts in sentences and multiple-choice tests were separated from the effects of providing such contexts in the sentences alone. Eighty-five third-and fourth-grade students from a racially and economically balanced, Southern elementary school participated in the study. Results indicated that when distinctive contexts were included both in related sentences and in multiple-choice test-item stems, recognition performance was significantly increased. However, the provision of distinctive contexts in the sentences alone did not enhance recognition memory. Results of the study are examined within the framework of the frequency theory of recognition memory.

Facilitating Recognition Memory: The Use of
Distinctive Contexts in Study Materials and Tests

Teachers often administer multiple-choice tests in which students are required to discriminate among highly related pieces of information in order to recognize the correct answers. In a recent study, Levin, Ghatala, and Truman (1979) demonstrated that interference between highly related sentences and test items can be significantly reduced when the sentences are presented with distinctive contexts (i.e., different background settings) and when the corresponding contexts are provided in multiple-choice test-item stems. From a practical standpoint, an unanswered question remains: to reduce intersentence interference and facilitate recognition, is it sufficient to provide distinctive contexts only in study materials, or is it also necessary to provide those same contexts in assessment instruments?

The frequency theory of recognition memory has been offered as one plausible explanation of an individual's ability to discriminate among correct and incorrect alternatives on multiple-choice tests (Levin, Ghatala, Subkoviak, Guttman, and Bender, 1978; Underwood, Patterson, and Freund, 1972). In a typical recognition memory task, subjects study a list of words and then take a test in which they must discriminate between "old" (studied) items and "new" items presented as distractors.

Frequency theory posits that discriminations among old and new items are made on the basis of a frequency differential. Because old items have been studied previously, they have a greater frequency than

new items, which have not been studied before. On a multiple-choice test then, recognition will occur if a subject perceives the frequency of each correct alternative to be greater than the frequency of each distractor. Errors will occur whenever a subject perceives the frequency of one or more distractors to be indistinguishable from the frequency of the correct alternative (Underwood et al., 1972).

In a study designed to extend the applicability of frequency theory to materials more like those studied in school, Levin et al. (1978) found that the theory as originally proposed (Underwood, 1971) could not completely explain recognition performance on some multiple-choice test items. In one of their experimental conditions, subjects were presented with a number of sentences like this:

"In his speech, the spaceman told how he laughed at the movie."

The multiple-choice test-item stem for this sentence was:

"What did the spaceman laugh at?"

The alternatives offered were:

"(a) the speech, (b) the movie, and (c) [another alternative]"

In this test item, "speech" and "movie" had the same "apparent" frequency because both had been presented in the study materials. According to frequency theory, discrimination between "speech" and "movie" would occur at a chance or 50% level. The results of the Levin et al. (1978) study indicated that the mean performance for this condition, 63 percent, was higher than the theoretical chance value. To account for this finding, the authors postulated that the correct response had acquired "contextual" frequency as a result of being encoded as part of

a larger idea unit. The correct response could then be selected more consistently because it had appeared in a context with the idea unit presented in the stem of the test-item. These results suggest that "contextual" frequency differences allow subjects to distinguish among correct and incorrect alternatives.

Ghatala, Levin, and Truman (1978) explicated contextual frequency as a theoretical construct and more clearly defined the types of frequencies which affect recognition. Specifically, they identified three frequency sources which operate in recognition memory tasks: item frequency, first-order contextual frequency, and second-order contextual frequency. Item frequency is the acquired familiarity or memory strength of individual words. First-order contextual frequency is defined as a within-sentence construct and refers to the memory strength of words related to other words in a sentence. For example, consider the following: The lady bought the hat. The lady walked the dog. "Hat" and "dog" acquire first-order contextual frequency because both occur with "lady"; in other words, both have the same memory strength with respect to the subject of the sentences. Second-order contextual frequency, on the other hand, is a between-sentence construct and refers to the larger context that each sentence implies. The student would probably infer different contexts from each of these sentences, since purchases are normally made in a store, and dogs are normally walked outside.

In their most recent study, Levin, Ghatala, and Truman (1979) specifically manipulated second-order contextual frequency (i.e., the larger context or background setting) to determine its effect on

recognition memory. Subjects were given pairs of sentences related in terms of first-order contextual frequency; e.g., "The lady bought the hat," and "The lady walked the dog." In one experimental condition, sentence pairs included different distinctive contexts; e.g., "In the store, the lady bought the hat," and "On the sidewalk, the lady walked the dog." Multiple-choice test items in this condition contained the distinctive contexts in the item stems; response choices included the correct answer, the previously associated incorrect answer, and a plausible new alternative. For example, "In the store, what did the lady buy? a) the hat, b) the dog, and c) the book." In terms of frequency theory, both "hat" and "dog" have the same item frequency; they also have the same first-order contextual frequency because they have occurred with "lady." However, "hat" and "dog" have different second-order contextual frequencies as a result of the different contexts; only "hat" has been associated with "store."

Levin et al. (1979) found that providing different distinctive contexts in the related sentence pairs and in the test-item stems as described significantly enhanced recognition performance when compared to providing either the same contexts or no contexts. This suggests that increasing second-order contextual frequency by means of distinctive contexts may override the interfering effects of alternatives which have the same item frequencies and the same first-order contextual frequency.

As a follow-up to the Levin et al. (1979) research, the present study attempts to further explore the effects of second-order contextual frequency on recognition memory for pairs of related sentences. The

effects of different contexts presented both in sentences and in test-item stems have been separated from the effects of such contexts presented in sentences alone. Specifically, the present study was conducted to address two questions of interest. First, when distinctive contexts are provided for related sentence pairs, will discrimination among response choices be enhanced when the same contexts are presented in multiple-choice test-item stems? Since the contexts in the sentences acquire frequency, providing contexts in test-item stems should enhance recognition performance when all other frequency sources are held constant.

Second, does the presence of different distinctive contexts in related sentence pairs serve to enhance discrimination among response choices when the contexts are not provided in the test-item stems? Since item frequency and first-order contextual frequency remain constant, adding different distinctive contexts in the sentences will enhance recognition of the correct alternatives only if subjects are able to recall the distinctive contexts of the item stems at the time of the recognition test.

Method

Sample

Eighty-five third- and fourth-grade children in four classes at the Florida State University Developmental Research School participated in the study. Students attending this school are selected by a quota system based on sex, race, academic ability, and family income so that the school population is normal relative to the population

of Tallahassee. The 43 male and 42 female subjects were considered to closely approximate the fourth- and fifth-grade students used by Levin et al. (1979), since the present study was conducted at the end of the school year.

Materials

To form study lists for the experiment, 18 sentence pairs were selected from the Levin et al. (1979) materials. All sentences were in the following format: article-subject-verb-article-object. The sentence pairs consisted of 18 target sentences, each matched with its own variation sentence. For half of the sentence pairs, the target and its variation shared the same subject.

For example:

The lady saw the flowers.

The lady walked the dog.

For the other half of the sentence pairs, the target and its variation shared the same object.

For example:

The boy kicked the ball.

The baby dropped the ball.

Two study lists were constructed using the 18 sentence pairs. For the first, called the no-context list, each of the 36 sentences was randomly assigned to a list position with the restriction that no target sentence could immediately precede or follow its variation. The second study list, called the context list, was identical to the first except

that a prepositional phrase describing a distinctive context was added to each sentence.

For example:

In the garden, the lady saw the flowers.

On the sidewalk, the lady walked the dog.

For half of the sentence pairs, different distinctive contexts were added at the beginning of each sentence; for the other half, they were added at the end. As with the sentences themselves, the contexts were adapted from the materials used by Levin et al. (1979). Each of the sentences was typed in Orator upper case on a 5 X 8 inch card for presentation to the students.

In order to measure recognition of information contained in the target sentences, two 18-item multiple-choice tests were also adapted from the Levin et al. (1979) materials. For the no-context test, each test item consisted of an item stem and four response choices: the target subject (or object), the variation subject (or object), and two new alternatives.

For example:

Target sentence:

The lady saw the flowers.

Variation sentence:

The lady walked the dog.

Test item:

What did the lady see?:

The flowers, the dog, the rabbit, the tree

Half of the test items probed for the target sentence's subject, and half probed for the object. All response alternatives were presented in alphabetical order.

The second multiple-choice test, the context test, was identical to the first except that the distinctive background setting for each target sentence was included in the test-item stem. Using the previous example, the test-item would be as follows: In the garden, what did the lady see?: the flowers, the dog, the rabbit, the tree.

It should be noted that several modifications were made to the Levin et al. (1979) materials. First, multiple-choice test items in the present study contained four response choices instead of three. This change was made to reduce the possibility of a ceiling effect as suggested by the original authors. It was believed that an additional distractor would make the recognition task more difficult (Klatzky, 1975). Second, several words were replaced so that the study lists and tests contained only words that were listed as fourth-grade or below on the Educational Developmental Laboratories (EDL) list of reading vocabulary words (Taylor, et al., 1979). Finally, several of the distinctive contexts were changed in order to be more congruent with information contained in the sentence. For example, "On the ranch, the cowboy bought the car" was changed to "In the city, the cowboy bought the car"; and "At the grocery store, the girl fed the rabbit" was changed to "On the farm, the girl fed the rabbit."

Procedure

Three experimental groups were formed by randomly assigning subjects to treatment conditions. In the Context/Context condition, subjects

received the context sentences and the context multiple-choice test. In the Context/No-Context Condition, subjects studied the context sentences and took the no-context test. In the No-Context/No-Context condition, subjects received the no-context sentences and the no-context test.

Originally, the entire third and fourth grades, a total of 107 students, were randomly assigned to the three treatment conditions. Because of time constraints, however, only 86 students actually participated. In addition, because of absence, one third-grade female was unavailable for testing. Although experimental mortality resulted in unequal numbers of subjects in the three treatment groups, there is no reason to believe that experimental mortality systematically biased the results of the study.

The following was the final distribution of 85 subjects: 32 subjects in the Context/Context group, 23 subjects in the Context/No-Context group, and 30 subjects in the No-Context/No-Context group. Subjects within each condition were further divided into small groups of two or three. Groups were randomly assigned to one of the three experimenters, so that the experimenters had an approximately equal number of groups from each condition.

One week prior to the experiment, a pilot study was conducted to standardize administration procedures among the three experimenters. Small groups of fifth-grade students participated, and the experimenters observed and critiqued each other's performances. As a result of the pilot study, instructions to subjects and general administration procedures were made consistent among the experimenters.

On the first afternoon of the study, the experimenters introduced themselves to the school's two third-grade classes and explained that they were interested in finding out more about how third-grade students learned sentences. Each experimenter then took an assigned group of two or three students from the intact class to one of the school's small conference rooms.

In the conference room, name tags were made and distributed to each subject. They were then given the following specific instructions (similar to Levin et al., 1979): "I will show you some cards with sentences on them. Please try to learn the sentences because later you will be asked questions about them. To help you remember, after you read each sentence, I want you to repeat it out loud three times. Repeat it all together, exactly the way you saw it on the card. Then I will ask one of you to say the sentence once more."

One practice sentence was read and repeated by the group, then the 36 sentences were presented one at a time on individual index cards. Each of the no-context sentences was displayed for four seconds, and each context sentence was displayed for five seconds. After the allotted time, the experimenter withdrew the card and the subjects repeated the sentence without prompting. If the group failed to execute the repetition strategy, the process was repeated.

After the group read and repeated each sentence, one subject was selected and asked to repeat the sentence once more. This check for mastery was intended to ensure that subjects had actually learned the sentences. If a subject failed to state the sentence correctly, the

entire group read and repeated the sentence again and the subject who missed the sentence was asked to repeat it one more time.

After the group completed the 36 sentences, the experimenter thanked them for their help and told them that the next day they would be asked some questions about the sentences. Subjects were requested not to discuss what they had done with their friends. Finally, they were directed to return to their classroom and send the next group of students to the experimenter.

On the second afternoon of the study, the same procedures were followed with the school's two fourth-grade classes.

Approximately 24 hours after learning the sentences, subjects were given a multiple-choice test. All members of the No-Context/No-Context and Context/No-Context groups received the same no-context test. Likewise, all members of the Context/Context group received the same context test. The regular classroom teachers administered the tests in accordance with written directions provided by the experimenters. Students were asked to recall the sentences they had learned the day before and to answer some questions about them. Teachers were told not to prompt the students in any way. As with Levin et al. (1979), students were given as much time as they needed to answer the questions. Tests were collected by the teachers and picked up later by the experimenters.

Results

Means and standard deviations were computed for the three experimental groups. The results are summarized in Table 1. To examine the effect of adding distinctive contexts in test-item stems, the difference

between means of the Context/No Context and Context/Context groups was tested for significance. To examine the effect of providing distinctive contexts in the sentence pairs, the difference between means of the No Context/No Context and the Context/No Context groups was tested for significance. Prior to conducting the t-tests, separate homogeneity of variance tests were conducted for the pairs of means (Ferguson, 1971). All statistical tests were conducted with an Alpha level of .05.

Insert Table 1 about here.

The Context/No Context and Context/Context groups had homogeneous variances, $F(22,31) = 1.59$. Based on a one-tailed t-test for independent samples, the mean of the Context/Context group was significantly greater than the mean of the Context/No Context group, $t(53) = 2.82$.

The variances of the No Context/No Context and Context/ No Context groups were also found to be homogeneous, $F(29,22) = 1.20$. A one-tailed t-test for independent samples indicated that there was no significant difference between the two means, $t(51) = 1.44$.

A post hoc analysis of student responses revealed that students frequently missed test items because they selected the variation subject (or object) instead of the target subject (or object). Seventy-three per cent of their errors were attributed to the selection of the interfering distractor.

Discussion

The results of this study confirm the hypothesis that providing distinctive contexts both in pairs of related sentences and in multiple-choice test-item stems results in improved recognition performance. From a theoretical standpoint, it appears that second-order context information in the item stem serves to reduce the interfering effects of response choices which have the same item frequency and the same first-order contextual frequency. When related pairs of sentences with distinctive contexts were presented and tested, subjects and objects remained distinguishable to the students. This finding supports the idea that second-order contextual frequency may be manipulated to reduce intersentence interference (Ghatala et al., 1978; Levin et al., 1979).

The second hypothesis of interest was not substantiated, namely that providing distinctive contexts for pairs of related sentences alone would enhance discrimination among response alternatives. On the contrary, when taking the no-context test, subjects who studied sentences with contexts performed no better than subjects who studied sentences without contexts. In order to perform better than the No Context/No Context group, the Context/No Context subjects would have had to recall the distinctive context of the test item stem, and then to recognize the correct test response by means of its second-order contextual frequency with the recalled context. It may be that these subjects failed to recall the context for each test item, or perhaps they recalled the context but failed to associate the correct response with the context. Additional research is needed to examine these various possibilities.

Given the frequency theory of recognition memory, it was not surprising to find that 73 per cent of the time, subjects erred by choosing the variation sentence subject (or object). The variation response choice had appeared previously, so it had greater item frequency and first-order contextual frequency than the two other distractors. This finding is consistent with the results of related research (Levin et al., 1979).

From a practical standpoint, the present study suggests the need to frame highly related information in distinctive contexts. If educators must present numerous facts about a particular subject, for example, they would be advised to put those facts in situational contexts that are clearly different from each other. The findings also indicate that in order to facilitate students' recognition performance, distinctive contexts must also be provided in subsequent multiple choice test-item stems. Additional research is required, however, before such an assessment practice can be confidently recommended for classroom use. The results of the present study do highlight the need to examine separately the stimulus materials and test items in future research on facilitating recognition memory.

References

- Ferguson, G. A. Statistical analysis in psychology and education. New York: McGraw-Hill, 1971.
- Ghatala, E. S., Levin, J. R., & Truman, D. L. Varieties of frequency interference in children's recognition of sentence information. Journal of Experimental Child Psychology, 1978, 25, 354-365.
- Klatzky, R. A. Human memory: structures and processes. San Francisco: W. H. Freeman and Company, 1975.
- Levin, J. R., Ghatala, E. S., Guttman, J., Subkoviak, M. J. & Bender, B. G. Frequency interference in children's recognition of sentence information. American Educational Research Journal, 1978, 15, 39-51.
- Levin, J. R., Ghatala, E. S., & Truman, D. L. Reducing intersentence interference via contextual aids. American Educational Research Journal, 1979, 16, 249-256.
- Taylor, S. E., Frankenpohl, H., White, C. E., Hieroda, B., Browning, C. L., & Birsner, E. P. E.D.L. core vocabularies in reading, mathematics, science, and social studies. New York: McGraw-Hill, 1979.
- Underwood, B. J. Recognition memory. In H. H. Kendler & J. T. Spence (Eds.), Essays in neobehaviorism. New York: Appleton-Century-Crofts, 1971.
- Underwood, B. J., Patterson, M., & Freund, J. S. Recognition and number of incorrect alternatives presented during learning. Journal of Educational Psychology, 1972, 63, 1-7.

Footnotes

We would like to thank Dr. Joel R. Levin of the University of Wisconsin Research and Development Center for Individualized Schooling for providing us the study lists and tests used in their work. We would also like to thank Drs. Robert Reiser and Walter Wager of Florida State University for their insightful comments on earlier versions of this paper. We are grateful to Dr. Edward Vertuno, Ms. Judy Arnett, Ms. Anne Black, Ms. Diane Ferrell, Ms. Harriette McCarter, and the 3rd and 4th grade students of the Developmental Research School, Florida State University, for their cooperation. The first author is now at Winthrop College and the third author is with the Florida House of Representatives. Requests for reprints should be sent to the second author.

Authors

Carol A. Marlin, Lecturer, School of Education, Winthrop College, Rock Hill, South Carolina, 29730. Specializations: Instructional Design and Development.

Ronald C. Laugen, Research Associate, Center for Studies in Vocational Education, Florida State University, Tallahassee, Florida, 32306. Specializations: Instructional Design and Development.

Teresa R. Hatch, Analyst, Florida House of Representatives, Committee on Education, K-12, Tallahassee, Florida, 32301. Specialization: Instructional Systems.

Table 1
Group Size, Means, and Standard Deviations,
as a Function of Experimental Condition

Experimental Condition

	Context/ Context	Context/ No-Context	No-Context/ No-Context
Group Size	32	23	30
Mean ^a	14.8	12.7	11.4
Standard deviation	2.44	3.08	3.38

^aNote that the maximum score is 18.